Pharmaceuticals and Personal Care Products (PPCPs) are among a new class of emerging environmental contaminants and include products used in daily life; shampoos, soaps, perfumes, lotions and human drugs to name a few. Though these compounds are likely to have existed in the environment for many years, their occurrence in the environment has only recently begun to elicit concern among the scientific and general public.

**Occurrence and Effects of PPCPs**

Pharmaceutical compounds are specifically designed to have biological effects and are not selective on the organisms they impact. Theo Colburn’s 1996 book, *Our Stolen Future*, brought world-wide attention to the fact that common environmental contaminants can act as endocrine disrupters, interfering with natural signals controlling fetal development in the womb. Other scientific discoveries have linked antibiotic resistance in viruses, bacteria and pathogens to their exposure to antibiotic drugs and steroids in the environment and the development of female reproductive organs in male fish (the feminization of fish) to the presence of birth control in the environment.

Exposure to PPCPs can be classified as either *acute* or *chronic*, each with the potential of having very different effects on organisms. Acute exposure includes single or limited exposure to relatively high concentrations of PPCPs while chronic exposure describes long-term, constant exposure to low concentrations of PPCPs. In the laboratory, acute exposure to different PPCPs has been shown to be particularly lethal to many organisms including invertebrates, algae, and fish. Short of a drug spill, however, concentrations associated with acute exposure are not likely to occur and do not pose a significant risk to environmental or human health.

The ubiquitous nature of these compounds, however, indicates that the threat of chronic exposure to PPCPs can be real. Unfortunately, the true chronic effects of PPCPs are not well understood, and thus cannot be quantified.

In addition to their occurrence in the environment, PPCPs have also been detected, albeit at low concentrations, in human drinking water sources. Most regulatory agencies, including the US Food and Drug Administration, the World Health Organization, and the European Medicines Agency do not believe this warrants immediate concern for public health.
Routes of Exposure

Though there are many different routes of exposure, PPCPs primarily enter the environment through two routes:

- **Wastewater Treatment Plants:** When you swallow a pill, you’re probably anticipating its effects in your body, not thinking about its ultimate destiny. Yet the drugs we consume, and their metabolites, are excreted from our bodies at a relatively high rate and eventually make their way to municipal or private wastewater treatment systems, which are relatively ineffective at removing PPCPs, and are released to the environment. Additionally, unwanted or unused drugs are often flushed down the toilet or rinsed down the drain, also leading to their ultimate release to the environment.

- **Agricultural Runoff:** Large-scale agricultural operations and concentrated animal feeding operations, often administer sub-therapeutic levels of steroids and antibiotics to their livestock to prevent illness and promote growth. Cattle, chicken and pigs excrete these drugs just like we do, and the drugs leach into groundwater or are carried directly into streams and rivers by runoff. Although they often are not classified as pharmaceuticals or personal care products, pesticides and herbicides also reach the environment primarily through agricultural runoff and have been shown to be pharmaceutically active.
**PPCPs in New Hampshire**

In 2009, the Squam Lakes Association, the NH Department of Environmental Services, the NH Water Resources Research Center, The Squam Lakes Conservation Society, and Plymouth State University collaborated to develop a method in-state to detect and measure for the PPCPs acetaminophen (an active ingredient in Tylenol), caffeine (found in soda and coffee), carbamazepine (an anti-seizure and mood stabilizing drug) and trimethoprim (an antibiotic).

Using this method, researchers investigated the occurrence of PPCPs in NH water resources. Samples were collected from a private septic system and lakes, rivers, and wastewater treatment facilities from across Central New Hampshire.

Preliminary results indicate that none of the lake samples contained any of the target PPCPs. Some river samples had concentrations of some of the targeted PPCPs on the range of about 80 parts per trillion, which is far below the range at which human and environmental health is considered to be at immediate risk. Samples from wastewater treatment plants were found to have concentrations of some PPCPs between 280 parts per trillion and 1,200 parts per trillion, also below current human and environmental health risk thresholds. One sample from a private septic tank had concentrations of both acetaminophen and caffeine above the instrument’s detection limit of 2,000 parts per trillion. The true concentration could pose a significant threat to environmental and/or human health, but it is not currently possible to know what that threat truly is.

**Minimizing Your Impact**

When you have an allergic reaction to a medication, requiring a new prescription, do you know what to do with the old medication? When a loved one has died, do you know what to do with their medicine cabinet full of drugs? What are you supposed to do with expired drugs? It may be news to you that flushing unused or unwanted drugs down the drain or toilet is not recommended. In fact, this disposal method releases PPCPs to our environment.

In 1997, the US Food and Drug Administration, working closely with the White House Office of National Drug Control Policy, published the first consumer guide for the proper disposal of prescription drugs. Their guidelines are summarized below:

- **Do not flush drugs down the toilet** unless specific instructions indicate that you should. (A number of regulated prescription drugs, including Percocet and Oxycontin should be flushed down the toilet to limit the risk of drug abuse or accidental poisoning.)

- **Place unwanted drugs in a sealable bag with coffee grounds or kitty litter.** This will make the drugs less appealing to animals and children, unrecognizable by people who may intentionally go through your trash and will prevent the medication from leaking out of the garbage. Ensuring the plastic bag is sealed tightly, **throw the package away with your household trash.**
Many state, federal and international organizations promote these same recommendations for the disposal of unwanted drugs, including the NH Department of Environmental Services, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the American Pharmacists Association, the Pharmaceutical Research and Manufacturers of America and the World Health Organization.

You can also be on the lookout for local take-back programs. Similar to hazardous waste days, drug take-back programs are events to which you can bring unwanted drugs and know that they’ll be disposed of properly. Typically, drugs collected at one of these programs end up being burned in very high-temperature incinerators, thus making them chemically inert.

To prevent collecting unwanted drugs in the first place, don’t fill new prescriptions in three-month batches (like most mail-order pharmacies promote). Until you know that you’re new medication works for you, fill prescriptions in monthly intervals. Also, don’t accept free samples of drugs from your doctor you have no intention of using.